https://doi.org/10.17221/355/2019-AGRICECON

Analysing farmers' intention to adopt web marketing under a technology-organisation-environment perspective: A case study in Italy

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Citation: Giampietri E., Trestini S. (2020): Analysing farmers' intention to adopt web marketing under a technology-organisation-environment perspective: A case study in Italy. Agric. Econ. – Czech, 66: 226–233.

Abstract: This study explores the factors that affect the intention to adopt web marketing (WM) at farm level as an innovation for business purposes. Data were collected from a direct survey among Italian farmers. The paper applies the Technology-Organisation-Environment (TOE) framework. Among the variables considered, the results mainly show that a higher perceived usefulness of WM leads to a greater intention to adopt it from farmers. Similarly, the intention to adopt WM is positively influenced by the customers' readiness to use this technology and the perceived ease of use. Moreover, the intention to adopt is lower for the farms showing a greater size. Surprisingly, the perception of customers' positive expectation about WM adoption by the farm shows a negative effect, suggesting that external pressures can inhibit farmers' intention. Findings are valuable to understand how to develop policies to support WM adoption among farmers, that is important to gain access to the market especially for smallholders.

Keywords: e-commerce; farm digitalization; innovation adoption; structural equation model; Technology-Organisation-Environment model

Jointly with the more recent European policy agenda that pushes for the modernization of the agricultural sector, an important goal for the European Union (EU) in the next future is represented by the development of internet infrastructures for farms, especially those located in rural areas (European Commission 2019). The adoption of information and communication technologies (ICT) represents an important way to tackle the problem of social isolation of rural areas and to promote the economic development of small farms that are vital to the community (Hennessy et al. 2016). Also, the farm's digitalisation and access to internet provide, among others, the adoption of web marketing (WM) tools that facilitate trading activities, in line with the radically changed modern needs and consumption features, thus representing a promising innovation for the agricultural sector (Mueller 2001). WM represents the body of marketing activities using the web to study the market and develop new business relationships, i.e. e-commerce (e.g. strategies, promotion/advertising, distribution, sales, customers' monitoring and support), specifically through social media, e-mail, trade platforms, online shop, and own website. According to Strzębicki (2015), smallholders can achieve a competitive advantage over competitors through this, by cutting costs and entering new markets, by overwhelming the frictions due to their small scale. Moreover, they can sell the product at a higher price as a consequence of the elimination of the price squeeze from intermediaries (Zeng et al. 2017). To sum up, WM is useful for: enhancing the visibility and the market access, especially for small and geographi-

Supported by AutoImp&Web, Project No. 1599-1-823-2016 financed by the European Social Fund – Veneto Region (Italy), D.G.R. No. 823, October 27th 2016.

https://doi.org/10.17221/355/2019-AGRICECON

cally remote farms; attracting a greater number of customers, also by re-establishing a direct contact between production and consumption; monitoring consumers' preferences; improving farmers' income (through reduced transaction costs) (Fecke et al. 2018).

In order to improve farmers' knowledge of WM potentialities and to incentivize their propensity to take up these tools[1], long ago the Common Agricultural Policy introduced several financing measures and budgeted many resources (e.g. financing training courses for farmers in the first pillar or the innovation measure in the second pillar).

As already mentioned by some authors, Fecke et al. (2018) have recently stated that there is a lack of studies focusing on this field and Zeng et al. (2017) pointed out that further research is useful to better clarify which are the factors that mainly influence farmers' intention to adopt, in order to support the design of more tailored policy strategies. Albeit the availability of internet access is important (Hennessy et al. 2016), Ma et al. (2019) affirm that it is not sufficient. The literature includes many relevant factors influencing the adoption: among others, firm's characteristics (e.g. leader's traits, business patterns) (Henderson et al. 2005), organizational readiness and perceived financial commitment, environmental readiness (e.g. customers' readiness) (Molla et al. 2010), perceived benefits from the adoption (Henderson et al. 2004), and transaction security (Solaymani et al. 2012).

Nowadays, the digitalisation represents a need for the Italian farmer (Bentivoglio et al. 2016), as it is still rare. Moreover, to the best of our knowledge, the literature on farmers' adoption of WM in Italy is still scarce. This paper provides a first attempt to explore the intention (INT) to adopt web marketing at farm level as an innovative marketing strategy, through a case study in Italy. The evidence on the drivers of the intention to adopt it are useful to better understand how to incentivize the adoption from a policy perspective, and shed light on further research directions.

MATERIAL AND METHODS

Data were collected through direct interviews conducted among Italian farmers in Veneto region during July–September 2017. These represented a convenient sample of participants in a training course on web marketing, thus farmers appropriately informed about the topic. They were asked to take part in a survey with a structured questionnaire, pre-tested on a small sample (N = 15). This research approach was recently recommended by Fecke et al. (2018), due to the absence of data on farmers' actual online sales. Finally, we collected 94 fully completed questionnaires.

The Technology-Organization-Environment (TOE) framework developed by Tornatzky and Fleischer (1990) has been widely used in the research on IT adoption (Aboelmaged 2014), as e-commerce or e-business tools (Zhu et al. 2006). According to this, all the factors that affect the decision to adopt a new technology by a firm (e.g. here represented by a farm) can be referred to three categories: the technological context (TC) representing the technology-related internal and external factors that can influence the adoption (Oliveira and Martins 2011); the organizational context (OC) including the firm's characteristics as the leader's opinion or the readiness to adopt the innovation; finally, the environmental context (EC) concerning the role of policy, competitors, trading partners and customers. Furthermore, every context is explained by a set of determinants. The study applies the TOE framework as a novel contribution to the understanding of farmers' adoption of WM: indeed, to the best of our knowledge, the extant literature applied TOE mainly to small and medium enterprises (SMEs), and a recent paper by Wang et al. (2019) to farmers' cooperatives.

In the opening session of the questionnaire a brief description of WM was provided to respondents, followed by socio-demographic questions. As regards TOE, the most part of the items included in the three contexts (organizational, technological, environmental) were adopted from Yoon and George (2013) with adjustments: these were measured using 5 point Likert-type scales ranging from 1 (totally disagree) to 5 (totally agree). In relation to the technological context, we included the relative advantages or perceived benefits of WM adoption as these represent an important attribute of the innovation (Rogers 1995); coherently with the literature (Alshamaila et al. 2013), we assume that the more farmers perceive they can derive benefits from the new technology (i.e. WM), and the greater their intention to adopt. To measure this, we proposed a 5 point (totally disagree-totally agree) semantic differential where respondents were asked to score their agreement with the following statement "I think that WM adoption at my farm is",

[1]It is plausible that in the future public funding will be targeted on moving digital marketing innovation in agriculture even under the umbrella of the European Innovation Partnership.

https://doi.org/10.17221/355/2019-AGRICECON

followed by two polar adjectives (e.g. negative-positive). Therefore, a Principal Component Analysis (PCA) with orthogonal rotation (varimax) condensed the 15 original pairs of adjectives into a few attitudinal principal components according to their correlation, and the Cronbach's alpha coefficient tested their reliability. Also, we measured the security concerns (*SEC*) and the perceived ease of use (*PEU*) (sometimes referred to as perceived complexity) through four and three statements, respectively. According to Yoon and George (2013), we assume that the perceived security is an influential factor in the intention to adopt. Coherently with the extant literature (Gangwar et al. 2015), although mainly focused on SMEs, the easier the new technology (both to be understood and used) and the more likely its adoption.

As regards the organizational context, this was investigated through statements related to: farm's top management support (*TMS*; 2 items), technological readiness (*TR*; 2 items) and financial readiness (*FR*; 3 items) to WM adoption; perceived lack of resources (*PLR*; 4 items); finally, we included the utilised agricultural area (*UAA*) as a proxy of farm size. In relation to *TMS* (here represented by the farm owner), the literature shows that the more the top manager is aware of IT benefits in building the firm's competitive advantage, the more likely the technology adoption will be; similarly, the more prone to innovation the top manager is, the higher the intention to adopt it at farm level (Yoon and George 2013; Awa et al. 2017). Albeit the organizational readiness is often investigated in the literature applying TOE on innovation technology adoption (Ramdani et al. 2009), here we split it into both the technological and the financial dimension. Moreover, we investigated the perceived lack of resources (*PLR*), given that financial constraints and the low familiarity with ICT represent two major barriers to farms' digitalization and to the innovation of the Italian agricultural sector in general. This is due to several frictions that exist in Italy as the small size of farms, their familiar nature and their scarce generational renewal, that actually do not easily promote their technological upgrade.

According to the extant literature (Yoon and George 2013; Awa et al. 2017), the environmental context (EC) was investigated through the coercive pressure (*CP*; 4 items) and the normative pressure (*NP*; 2 items), being the former the environmental pressure (customers' expectations) and the latter the perceived customers' e-readiness. In line with the literature on SMEs (Ghobakhloo et al. 2011; Rahayu and Day 2015), we assume that the higher the customers readiness to use the new technology and the higher their pressure to adopt exerted on the farm, the higher the farm's intention to adopt the innovation.

Finally, the intention to adopt WM was measured through the following dummy variable (yes/no): "My farm intends to adopt WM tools in the near future".

To sum up, we hypothesized as follows:

H_1: security concerns influence *INT*;
H_2: perceived ease of use influences *INT*;
H_3: positive attitudes (i.e. relative advantages) towards WM adoption influence *INT*;
H_4: farm's top management support influences *INT*;
H_5: technological readiness influences *INT*;
H_6: financial readiness influences *INT*;
H_7: perceived lack of resources influences *INT*;
H_8: size (*UAA*) influences *INT*;
H_9: normative pressure influences *INT*;
H_{10}: coercive pressure influences *INT*.

To conclude, a structural equation model (SEM) performed with the AMOS package measured the simultaneous effects among the above mentioned variables.

RESULTS AND DISCUSSION

The sample is mainly composed by men (64%) and the average age is 48 years (Table 1). They mainly have an upper secondary school level of education (55%) and an average farm revenue 100 000–200 000 EUR per year. The farms are mainly located in lowland (65%) and have an average size of 34 hectares. The 40% of the farms represent a new settlement (i.e. the company is less than 5 years old), 21% show a diversified farm activity (agroturism) and 23% run an organic farm. Finally, the majority of respondents (76%) state that the own farm intends to adopt web marketing in the near future.

A principal component analysis condensed the original 15 items of the semantic differential in two principal components [Table S1; Table S1 in electronic supplementary material (ESM); for the supplementary material see the electronic version]: the first (*PC*1) refers to the usefulness of web marketing (α = 0.942; 12 items), whereas the second (*PC*2) refers to the reliability and profitability of this innovation (α = 0.855; 3 items). In the academic literature on SMEs, the profitability is considered as a perceived benefit deriving from the technology adoption (Levenburg et al. 2005; Burke 2010).

In Table S2 [Table S2 in electronic supplementary material (ESM); for the supplementary material see the electronic version] the Cronbach's alpha (α) coefficients demonstrate an acceptable reliability of the items

https://doi.org/10.17221/355/2019-AGRICECON

Table 1. Sample descriptive statistics

Variable category	Description	Number of observations	Percentage (%)	Mean	S.D.
Age	years	–	–	47.9	16.02
Gender	1 = female	34	36.2	–	–
	0 = male	60	63.8		
Education level	1 = primary school	5	5.3	–	–
	2 = lower secondary school	22	23.4		
	3 = upper secondary school	52	55.3		
	4 = university degree	15	16.0		
Average farm revenue (EUR/year)	1 = less than 50 000	3	3.2	–	–
	2 = 50 000–100 000	39	41.5		
	3 = 100 000–200 000	52	55.3		
	4 = more than 200 000	0	0.0		
Altitude	1 = lowland	61	64.9	–	–
	2 = hill	27	28.7		
	3 = mountain	6	6.4		
Utilised agricultural area (*UAA*)	hectares	–	–	33.9	207.66
New farm	1 = less than 5 years old	38	40.4	–	–
	0 = more than 5 years old	56	59.6		
Agroturism	1 = yes	20	21.3	–	–
	0 = no	74	78.7		
Organic production	1 = yes	22	23.4	–	–
	0 = no	72	76.6		
Farm (main) production	cereals	22	23.4	–	–
	vegetables	33	35.1		
	fruits	32	34.0		
	milk	6	6.4		
	cattle	6	6.4		
	chicken	8	8.5		
	pig	8	8.5		
	wine	31	33.0		
	olive oil	12	12.8		
	jam	15	16.0		
	meat	8	8.5		
	cheese	6	6.4		
	eggs	7	7.4		
	honey	12	12.8		
	flour	4	4.3		
	bread/biscuits	3	3.2		
	cold meats	11	11.7		
	other	16	17.0		
Intention to adopt web marketing (*INT*)	1 = yes	71	75.5	–	–
	0 = no	23	24.5		

Source: Own elaboration

https://doi.org/10.17221/355/2019-AGRICECON

for each latent construct (being always greater than 0.7). Overall, we notice that the mean value is never lower than the scale mean, showing that: farmers generally believe that web marketing is secure (*SEC*) and easy to use (*PEU*); the farm owner supports and encourages the adoption of WM (*TMS*); the farm is both technologically (*TR*) and financially (*FR*) ready to use WM; finally, the adoption at farm level requires additional resources as investments, additional work, staff and training (*PLR*). Finally, farmers agree that their customers are both familiar with WM (*NP*) and in favor of its adoption at farm level (*CP*). Furthermore, the standardized factor loadings are greater than the conventional cut-off value of 0.5 and are significant at 1% level.

Table 2 shows the fitness of the proposed TOE model (Figure 1) estimated through structural equation modelling (SEM). Interestingly, the variance of farmers' intention is explained up to 64%. According to Hu and Bentler (1999) and Schreiber et al. (2006), an acceptable model fit is represented by the following cut-off values: the ration between χ^2 and the degrees of freedom (*CMIN*/*DF*) ≤ 2 or 3, the root mean square error of approximation (*RMSEA*) < 0.08, and the comparative fit index (*CFI*) > 0.90; hence, looking at the indices we can confirm that our model estimation guarantees a good fit.

Our findings reveal that the intention to adopt WM is influenced by many variables belonging to the three TOE's dimensions. With regard to the technological context, the higher the perceived usefulness of WM and the higher the intention (β_{PC1} = 0.361), in line with findings of Henderson et al. (2004) and Jia et al. (2017). Moreover, the more the respondents perceive that the use of WM is effortless and the higher is their intention to adopt (β_{PEU} = 0.315). Both these variables are found to be valid predictors of people's acceptance of information technology by the literature (Jamaluddin 2013). Finally, we found a significant and positive effect for *PC*2, meaning that the greater is the perceived reliability and profitability of WM (i.e. the individual privacy is protected) and the higher is the intention to adopt it

Table 2. Structural equation model estimation

Dependent variable: intention to adopt web marketing at farm level (*INT*)		β	S.E.	Significance
Technological context	web marketing usefulness (*PC*1)	0.361	0.029	***
	web marketing reliability and profitability (*PC*2)	0.127	0.029	*
	security concerns (*SEC*)	0.019	0.051	–
	perceived ease of use (*PEU*)	0.315	0.085	**
Organizational context	top management support (*TMS*)	0.322	0.076	*
	technological readiness (*TR*)	–0.573	0.167	–
	financial readiness (*FR*)	0.225	0.121	–
	perceived lack of resources (*PLR*)	–0.166	0.054	–
	utilised agricultural area (*UAA*)	–0.169	0.000	**
Environmental context	normative pressure (*NP*)	0.874	0.121	***
	coercive pressure (*CP*)	–0.404	0.080	**
Control variables	gender	0.162	0.060	**
	age	0.084	0.002	–
	altitude	0.223	0.047	*
	agroturism	–0.061	0.070	–
R^2			0.644	
CMIN/*DF*			1.594	
CFI			0.900	
RMSEA			0.080	
Chi-square			680.732	
df			427	
Probability			0.000	

*, **, *** denote 10, 5 and 1% level of significance, respectively; *CMIN*/*DF* – ration between χ^2 and the degrees of freedom; *CFI* – comparative fit index; *RMSEA* – root mean square error of approximation

Source: Own elaboration

https://doi.org/10.17221/355/2019-AGRICECON

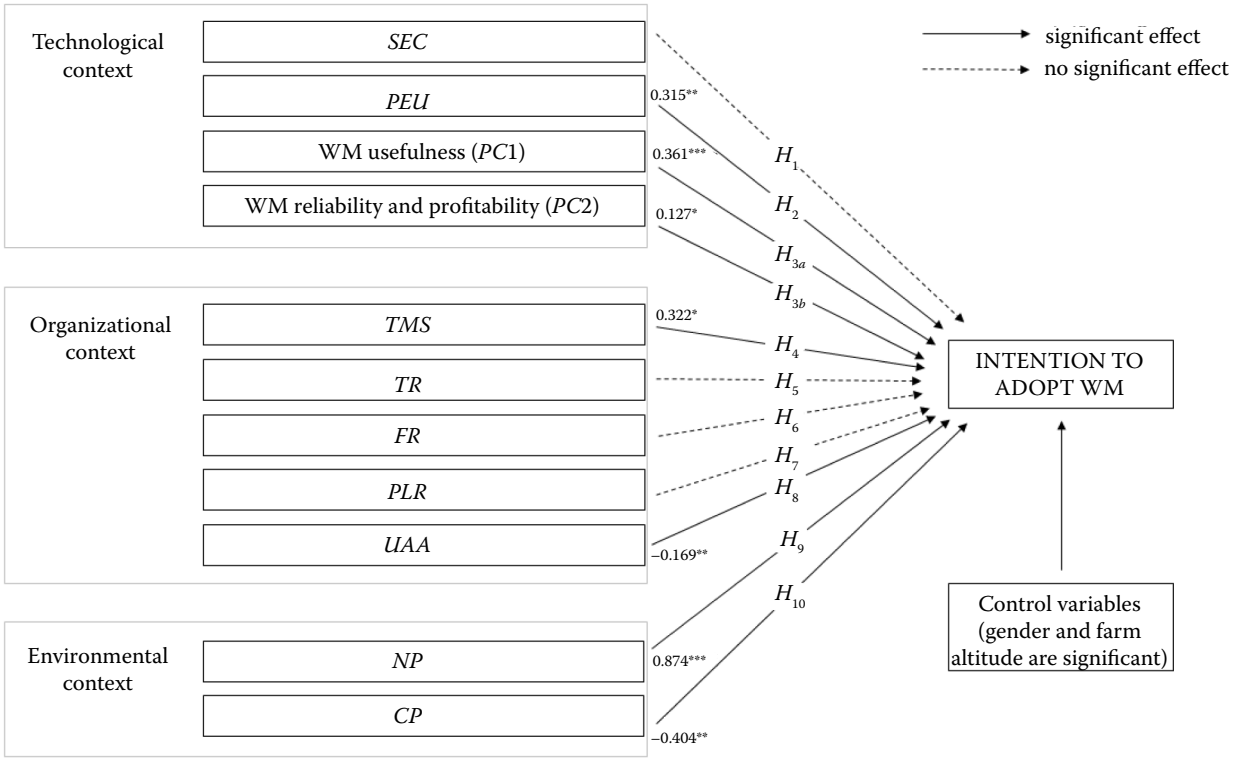

Figure 1. Structural equation model

*, **, *** denote 10, 5 and 1% level of significance, respectively; WM – web marketing; *SEC* – security concerns; *PEU* – perceived ease of use; *PC*1 and *PC*2 – principal component 1 and 2; *TMS* – top management support; *TR* – technological readiness; *FR* – financial readiness; *PLR* – perceived lack of resources; *UAA* – utilised agricultural area; *NP* – normative pressure; *CP* – coercive pressure

Source: Own elaboration

(β_{PC2} = 0.127). In relation to the organizational context, the results show a significant effect on *INT* only for the top management support (β_{TMS} = 0.322), meaning that the more the farm owner is in favor of WM adoption and the higher is *INT*, as shown by Awa et al. (2017). Conversely, no significant effects are found for the technological and the financial readiness, and the perceived lack of resources, as opposite to the literature (Chewlos et al. 2001). As opposite to what found by Henderson et al. (2005) for agribusiness firms and by Awa et al. (2017) for small service enterprises, but consistently with Molla et al. (2010), we found that the greater is the size of the farm (here represented by the number of hectares) and the lower is *INT* (β_{UAA} = –0.169). According to what stated by Oliveira and Martins (2011) for SMEs, we assume that this might be due to the fact that a big farm is less flexible and thus potentially less reactive towards this kind of innovation or at least for planning its adoption, compared to a small farm, even if it has more resources to invest.

As regards the environmental context, we find that the more the customers make use of and are familiar with WM tools (β_{NP} = 0.874) and the higher is the farms' intention to adopt this innovation. This is consistent with the findings of Yoon and George (2013) on virtual words adoption. Surprisingly, the resulting information from the negative sign of *CP* was not expected: the intention to adopt decreases the more the customers' expectation related to the farm's WM adoption increases (β_{CP} = –0.404). A possible reason for this could be the fact that the investigated farms actually attempt a transition from a commodity market, where WM adoption is not strictly necessary as farms do not risk to lose customers without it, towards a specialty market, where the direct contact with the customer is entirely central, even digitally. Indeed, farms that are not involved in a commodity market may seek to increase their market share and emancipate from their actual clients through the digitalization, driven especially from the perceived benefits from this innovation strategy instead of any external pressure (to move to WM) from customers. Accordingly, farms that usually run direct sales may guarantee good results even with-

https://doi.org/10.17221/355/2019-AGRICECON

out a technological transition, despite the demand for digitalization from their customers.

To conclude, we found that women (β_{gender} = 0.162) are more likely to adopt WM, compared to men. Also, farms located in marginal areas (as mountains) are more likely to gain visibility on the market through technology adoption ($\beta_{altitude}$ = 0.223). Surprisingly, both the variables agroturism and the age do not affect the intention. In summary, we can accept all the hypothesis made except H_1, H_5, H_6, and H_7.

CONCLUSION

By considering all the contexts (internal and external) in which a farm fits into, the proposed TOE framework aimed at providing a comprehensively holistic analysis of what drives the intention to adopt web marketing. This understanding, indeed, may provide potential guidelines for future policy and marketing strategies to accelerate the WM uptake among farmers, in order to strengthen the competitiveness and sustainability of the agricultural sector, that notoriously suffers from a poor visibility on a global level. The results show some first insights on this topic and the application of TOE to farmers represents a novel contribution for the Italian literature. From the results clearly emerges how both the perception of the WM usefulness and the awareness that the customers are ready and able to use this technology mostly influence the intention to adopt, as well as the perceived ease of use of WM tools. Findings clearly show the prominent effect of the environmental context on the intention. However, the negative effect of coercive pressure is surprising, suggesting that WM adoption does not represent a blind farm's obedience to customers' expectations. Thus, the farm's intention is mainly driven by the own development needs and perceived benefits from the adoption, while the coercive pressure is a potential inhibitor, requesting some further investigation. Future research may seek to understand if the demand for WM is linked to some other farms' strategies as direct sale or diversification; we tried to check this through the variable agroturism, being digital platforms increasingly crucial for these business activities nowadays, but without significant evidence.

From a policy perspective, the results may suggest that financing training courses among farmers and especially for the farm owner can be strategically important: this should facilitate the use of WM tools and inform about their security. Indeed, the literature on SMEs broadly emphasized the need for new technologies to be understood and used, in order to facilitate their adoption. However, we found a big difference between SMEs and farms with regard to the size effect: big farms show a lower intention to adopt, compared to what happens for SMEs, suggesting that what drives farmers' decision requires further investigation. Moreover, funding measures to support the introduction of specific digital assets at farm level could facilitate WM adoption; this may be carried out by the regional Rural Development Plans in Italy whose aim, among others, is represented by the valorisation of small farms located in marginal areas (e.g. mountain), indeed.

To conclude, the main limitation of the present study concerns the sample that does not reflect the Italian farms' population, thus preventing the generalizability of the results. However, this paper provides, as a novel contribution, the evidence about the adequacy of the TOE framework to explain the intention to adopt technological innovations as web marketing by the farms, and not only for SMEs which the extant literature is limited to so far. Thus, as this topic is more and more relevant nowadays and deserves further analysis, we hope that this study can be of inspiration for future investigation that will reasonably focus on a representative sample of farms.

Acknowledgement. We thank Serena Szathvary and Sofia Destro for helping us to collect the data from direct interviews among farmers.

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Received: November 5, 2019
Accepted: February 22, 2020